WE CLAIM:

1. In a computer system having a processor, a memory unit, an input device and an output device, a method for deducing user goals and for executing at least one task to accomplish user goals, the method comprising computer implemented steps of:

5   (a)   representing at least one of a user's goals, beliefs, assumptions, preferences, and changes of state with respect to a specific domain or composition of domains;

       (b)   representing at least one task which can be accomplished in particular domains, and at least one of the vocabulary, idioms, or goals that correspond with those tasks;

       (c)   representing human/system transactions in discourse between entities;

10   (d)   inferring at least one of a user's goals, beliefs, assumptions, preferences, and changes of state incrementally from elements of discourse, domain models, and results of previous interactions;

       (e)   recognizing user input as an attempt to accomplish goals in one or more levels of discourse;

15   (f)   executing at least one task corresponding to at least one user goal; and

       (g)   optionally conveying related information to the user.

2. The method of claim 1 wherein representing user/system transactions in discourse between entities comprises:

       (a)   receiving signals from at least one user by at least one computer system through
20   at least one communication channel; and

       (b)   generating signals from at least one computer system to at least one user through at least one communication channel.

3. The method of claim 2, wherein inferring at least one of a users goals, beliefs, assumptions, preferences, and changes of state incrementally from elements of
25 discourse further comprises:

representing at least one of terminology, ontological, lexical, grammatical, idiomatic, or item of focusing information with respect to a specific domain or composition of domains.

4. The method of claim 3, wherein representing at least one of terminology, ontological, lexical, grammatical, idiomatic, or item of focusing information further comprises:

composing at least one of ontological, lexical, grammatical, idiomatic, and focusing information from several domains or sub-domains in order to provide interpretation of user's input with respect to those domains.

5. The method of claim 3, wherein inferring a user's goals, beliefs, assumptions, preferences, and changes of state incrementally from elements of discourse further comprises:

(a) maintaining a map of domain and domain transition adjacency, and using the map as an aid to plan recognition or focus recognition; and

(b) using plan recognition or focus recognition to identify at least one of the likely beliefs, assumptions, preferences, and changes of state experienced by the user.

6. The method of claim 2, further comprising:

determining the likely meaning of well-formed or ill-formed input, using at least one technique selected from the group consisting of:

(a) partial matches of user input;

(b) a collection of plausible user intentions;

(c) sub-domain models;

(d) a model of typical user beliefs and goals;

(e) a model of stratified user beliefs and goals;

(f) a historical model of a particular user's beliefs and goals;

(g) a session model of a particular users interactions, and

(h)   a domain adjacency map.

7. The method of claim 2, further comprising:

adapting the interactive capabilities of a system to at least one of a population of users, a sub-population of users, individual users or individual user-sessions.

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8. The method of claim 2, further comprising:

providing simple, unambiguous references to complex items that are communicated from user to a computer and from a computer to a user, by tagging each turn of discourse with at least one of number, time, entity, focus, medium, and with a list of attributes and their bindings.

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9. The method of claim 2, further comprising:

communicating the suppositions of a discourse system to a user and permitting the user to improve the performance of the system by signaling agreement or disagreement with particular suppositions.

10. The method of claim 9, further comprising:

15   rating plans and actions by their danger or irreversibility, and using such ratings to control the generation of paraphrases and requests for confirmation.

11. The method of claim 2, further comprising:

making information useful to users by displaying only the information that contributes to the goals that they are trying to accomplish.

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12. The method of claim 2, further comprising:

at least one of capturing expert patterns of use, creating libraries, packages, and explanations of those patterns, and transmitting expert patterns to novice users, by portraying expert event sequences.

13. The method of claim 2, further comprising:

25   invoking several parse-related tasks concurrently to examine their feasibility and results in order to derive the likely meaning of a user input.

14. The method of claim 2, further comprising:

representing multiple types of goals in discourse, including at least one of domain goals, problem-solving goals, and discourse goals.

15. The method of claim 2, further comprising:

constructing canonical paraphrases that reduce ambiguity by choosing terms and constructions which are more explicit or more idiomatic to a given sub-domain.

16. The method of claim 7, further comprising:

(a)   accomplishing information gathering tasks; and

(b)   conveying related information to the user in a form that is appropriate to at least one of user preferences, the volume of data, and the available media.

17. The method of claim 2, wherein receiving signals from at least one human by at least one computer system through at least one communication channel uses at least one modality selected from the group consisting of:

(a)   natural language text

(b)   mouse actions;

(c)   human speech;

(d)   whistles, gestures;

(e)   pedal movements;

(f)   facial expression changes; and

(g)   postural changes.

18. The method of claim 2, wherein generating signals from at least one computer system to at least one human through at least one communication channel uses at least one medium selected from the group consisting of:

(a)   natural language text;

(b)   automatically-generated speech;

(c)   non-speech audio media;

(d)   displays of graphs;

(e)   displays of tables;

(f)   animation of pictures;

(g)   display of recorded video;

(h)   mechanical pressure transducers;

(i)   thermal transducers;

(j)   olfactory stimulators; and

(k)   taste stimulators.

19. The method of claim 2, further comprising:

extracting useful sequences of discourse interaction from logs and associating resulting scripts with at least one of meaningful names or phrases, so that the scripts can be retrieved and interpreted.

20. The method of claim 19, wherein the extracted sequences are generalized by replacing at least one component with a variable to be provided from context, or from interactive specification, when the script is interpreted by the system.

21. The method of claim 2, wherein the step of inferring at least one of a users goals, beliefs, assumptions, preferences, and changes of state incrementally from at least one of elements of discourse, domain models, and results of previous interactions uses at least one method of calculation selected from the group consisting of:

(a)   Bayesian probability network calculations;

(b)   Dempster-Schafer evidence calculations;

(c)   MYCIN-style certainty factors;

(d)   Dragoni-Giorgini belief revision functions; and

(e)   Fuzzy-Logic inference.

22. A human-computer interface system, comprising:

(a)   a means of representing at least one of user goals, beliefs, assumptions, preferences, and changes of state with respect to a specific domain or composition of domains;

5   (b)   a means of representing at least one task which can be accomplished in particular domains, and at least one of the vocabulary, idioms, or goals that correspond with those tasks;

(c)   a means of representing human/system transactions in discourse between entities;

10   (d)   a means of inferring at least one of a user's goals, beliefs, assumptions, preferences, and changes of state incrementally from at least one of elements of discourse, domain models, and results of previous interactions;

(e)   a means of recognizing user input as an attempt to accomplish goals in one or more levels of discourse;

15   (f)   a means of executing at least one task corresponding to at least one user goal; and

(g)   a means of conveying related information to the user.

23. The system according to claim 22, wherein the means of representing human/system transactions in discourse between entities comprises;

20   (a)   a means of receiving signals from at least one human by at least one computer system through at least one communication channel, and

(b)   a means of generating signals from at least one computer system to at least one human through at least one communication channel.

24. The system according to claim 23, wherein the means of inferring at least one of a user's goals, beliefs, assumptions, preferences, and changes of state incrementally from elements of discourse further comprising:

a means of representing at least one of terminology and ontological, lexical, grammatical, idiomatic, and focusing information with respect to a specific domain or composition of domains;

25. The system according to claim 24, wherein the means of representing at least one of terminology and ontological, lexical, grammatical, idiomatic, and focusing information further comprising:

(a)   composing at least one of ontological, lexical, grammatical, idiomatic, and focusing information from several domains or sub-domains in order to provide interpretation of user's input with respect to those domains.

26. The system according to claim 24, wherein the means of inferring at least one of a user's goals, beliefs, assumptions, preferences, and changes of state incrementally from elements of discourse further comprising:

(a)   a means of maintaining a map of domain and domain transition adjacency, and using the map as an aid to plan recognition and focus recognition; and

(b)   a means of using plan recognition and focus recognition to identify at least one of the likely beliefs, assumptions, preferences, and changes of state experienced by the user.

27. The system according to claim 23, further comprising:

a means for determining the likely meaning of well-formed or ill-formed input, using at least one technique selected from the group consisting of:

(a)   partial matches of user input,

(b)   a collection of plausible user intentions,

(c)   sub-domain models,

(d)   a model of typical user beliefs and goals,

(e)   a model of stratified user beliefs and goals,

(f)   a historical model of a particular user's beliefs and goals,

(g)   a session model of a particular users interactions,

(h)   a domain adjacency map.

28. The system according to claim 23, further comprising:

a means of adapting the interactive capabilities of a system to at least one of a population of users, a sub-population of users, individual users or individual user-sessions.

29. The system according to claim 23, further comprising:

a means of providing simple, unambiguous references to complex items that are communicated from a user to a computer and from a computer to a user, by tagging each turn of discourse with at least one of number, time, entity, focus, medium, and with a list of attributes and their bindings.

30. The system according to claim 23, further comprising:

a means of communicating the suppositions of a discourse system to a user and permitting the user to improve the performance of the system by signaling agreement or disagreement with particular suppositions.

31. The system according to claim 30, further comprising:

a means of rating plans and actions by their danger or irreversibility, and using such ratings to control the generation of paraphrases and requests for confirmation.

32. The system according to claim 23, further comprising:

a means of making information useful to users by displaying only the information that contributes to the goals that they are trying to accomplish.

33. The system according to claim 23, further comprising:

a means of at least one of capturing expert patterns of use, creating libraries, packages, and explanations of those patterns, and a way of transmitting expert patterns to novice users, by portraying expert event sequences.

34. The system according to claim 23, further comprising:

a means of invoking several parse-related tasks concurrently, in order to examine their feasibility and results, in order to derive the likely meaning of a user input.

35. The system according to claim 23, further comprising:

a means of representing multiple types of goals in discourse, including, at least one of domain goals, problem-solving goals, and discourse goals

36. The system according to claim 23, further comprising:

5   a means of constructing canonical paraphrases that reduce ambiguity by choosing terms and constructions which are more explicit or more idiomatic to a given sub-domain;

37. The system according to claim 28, further comprising:

(a)   a means for accomplishing information gathering tasks; and

(b)   a means for conveying related information to the user in a form that is
10   appropriate to at least one of user preferences, the volume of data, and the available
          media.

38. The system according to claim 23, wherein the means of receiving signals from at least one human by at least one computer system through at least one communication channel uses at least one modality selected from the group consisting of:

15   (a)   natural language text

(b)   mouse actions;

(c)   human speech;

(d)   whistles, gestures;

(e)   pedal movements;

20   (f)   facial expression changes; and

(g)   postural changes;

39. The system according to claim 23, wherein the means of generating signals from at least one computer system at least one human through at least one communication channel uses at least one medium selected from the group consisting of:

25   (a)   natural language text;

(b)   automatically-generated speech;

(c)   non-speech audio media;

(d)   displays of graphs;

(e)   displays of tables;

5   (f)   animation of pictures;

(g)   display of recorded video;

(h)   mechanical pressure transducers;

(i)   thermal transducers;

(j)   olfactory stimulators; and

10   (k)   taste stimulators

40. The system according to claim 23, further comprising:

a means of extracting useful sequences of discourse interaction from logs and associating resulting scripts with at least one of meaningful names or phrases, so that the scripts can be retrieved and interpreted in some later time.

15   41. The system according to claim 40, wherein the extracted sequences are generalized by replacing at least one component with a variable, provided from context or from interactive specification when the script is interpreted by the system.

42. The system according to claim 23, wherein the means of inferring at least one of a users goals, beliefs, assumptions, preferences, and changes of state
20   incrementally from at least one of elements of discourse, domain models, and results of previous interactions uses at least one method of calculation selected from the group consisting of:

(a)   Bayesian probability network calculations;

(b)   Dempster-Schafer evidence calculations;

25   (c)   MYCIN-style certainty factors;

(d)   Dragoni-Giorgini belief revision functions; and

(e)   Fuzzy-Logic inference.